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Susceptibility for Hepatitis B Infection within the United States Population with
Special Focus on African American Females.

By

Dajuana D. Phillip

B.A., Georgia Southern University

A Thesis Submitted to the Graduate Faculty of Georgia State University in Partial Fulfillment of
the Requirements for the Degree

MASTER OF PUBLIC HEALTH

ATLANTA, GEORGIA 30303

APPROVAL PAGE

Susceptibility for Hepatitis B Infection within the United States Population with
Special Focus on African American Females.

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ABSTRACT

Dajuana D. Phillip

Susceptibility for Hepatitis B Infection within the United States Population with Special Focus on African American Females.

(Under the direction of Richard Rothenberg, MD, MPH)

In 2010, the Hepatitis B virus (HBV) infected 1.2 million people in the United States, many of whom were unaware of their infection (CDC, 2010). The available research on HBV infection is predominately among Asian American, Native Hawaiian, and other Pacific Islander. HBV infection and Human Immunodeficiency Virus (HIV) infection share similar modes of transmission. Very little HBV research has been dedicated to the African American females; who accounted for 29% of the new HIV cases among young adolescents in 2010 (CDC, 2010). Due to the common mode of transmission of HIV and Hepatitis B many persons at risk for HIV are also at risk for contracting Hepatitis B. One's risk for acquisition of HBV can be mitigated or eliminated by vaccination or naturally acquired immunity. In the absence of both, an individual is susceptible to acquisition of HBV. The aims of this study are to define susceptibility of non-Hispanic, blacks to Hepatitis B infection compared to other races as well as defining possible risk factors that may increase or decrease their susceptibility.

Index words: Hepatitis B virus, African American, females, susceptibility

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CHAPTER I- Brief Introduction

In recent literature, noninfectious diseases (i.e. heart disease, diabetes, asthma etc.) have been spotlighted in the arena of public health. This focus; however, may need to be shifted or shared due to the reemergence of some infectious diseases. One such disease is Hepatitis B (HBV). “Hepatitis B is an infectious liver disease that results from infection with the Hepatitis B virus (CDC, 2010).” This disease is spread by blood, semen and other bodily fluids from infected persons {CDC, 2010}. Hepatitis can affect the individual temporarily (acute hepatitis) or over the course of one’s life (chronic hepatitis). The latter condition is the most serious form of the disease and can cause extreme liver damage and death. “An estimated 15-20 % of people infected with chronic HBV will die prematurely from cirrhosis liver failure, or primary liver cancer (Cohen et al., 2013).” There is a vaccine offered throughout the world which has been effective in industrialized countries and mitigated the economic impact of the disease (Stasi, 2014). The vaccine produces the Hepatitis B surface antibody which gives the vaccinated person immunity to future infection of the virus. This same immunity can developed in a non-vaccinated person who has recovered from a Hepatitis B infection (CDC, 2008). Immunity from the virus prevents one from future infection and chronic Hepatitis B.

Despite efforts to eradicate this disease, there are over 2 billion individuals affected by HBV worldwide (Stasi, 2014). In 2010, 1.2 million individuals in the United States were infected by the virus and many of whom were unaware of their infection (CDC, 2010). The available research on HBV infection is predominately among Asian American, Native Hawaiian, and other Pacific Islander (Cohen et al., 2013). Very little research has been dedicated to the non-Hispanic black population. Many of the risk factors correlated with the acquisition of hepatitis B infection are risk factors common among non-Hispanic black females. These risk factors also facilitate the

acquisition of Human Immunodeficiency Virus (HIV) infection. Conceivably, because of similar risk factors for acquisition of HBV and HIV, one may posit that HBV infection rates and HIV infection rates are similar in high risk populations.

The aims of this study are to define susceptibility of non-Hispanic blacks to Hepatitis B infection compared to other races as well as defining possible risk factors that may increase or decrease their susceptibility.

CHAPTER II – Review of Literature

Epidemiology of Hepatitis B in non-Hispanic Black females

CDC surveillance data indicated a decrease in the incidence rate of Hepatitis B from 2000-2012 across all race/ethnicities. Despite the noted overall decreasing trend, acute Hepatitis B infection rates are highest among non-Hispanic blacks. This is in contrast to Asian/Pacific Islanders and Hispanics with the lowest rate (0.4 cases per 100,000 for each population). Non-Hispanic blacks in 2012 were found to have 1.1 cases per 100,000 population. The 2012 data indicated that the rate for females in the surveillance data was 0.68 cases per 100,000 populations (CDC, 2014)

Presently there are very little published surveillance studies which explore Hepatitis B among African Americans; African American females in particular. Most available research provides generalized surveillance data of the disease in terms of race or gender but rarely both.

HIV

There were 872,990 persons living within the United States with an HIV diagnosis at the end of 2010 (CDC, 2014). African Americans were 9 times more likely than whites to receive a positive diagnosis (CDC, 2014). CDC also stated that in 2011 1 in 4 of the diagnosed HIV positive person could be traced to heterosexual contact. These findings illustrate the importance of not just focusing on “men who have sex with men” but also heterosexual relationships.

African American women account for 29% of the new HIV infections among adults and adolescents in 2010 (CDC, 2010). African American women HIV infection rate in 2010 was 20 times higher than non-Hispanic white women and 5 times higher than Hispanic women (Blank et al. 2015).

Due to the common routes of infection, co-infection (HBV and HIV) is common among high risk individuals. Persons with HIV or at risk of contracting HIV are recommended to also be screened for Hepatitis B (CDC, 2010). Blank et al., provided HIV testing as well as Hepatitis B testing to participants in their HIV focused study and found that women who were diagnosed with co-infection often practiced risky sexual behavior and were also found to be underprivileged (Blank et al., 2015).

The rise in HIV incidence in African American women may parallel trends observed in African American women who test positive for Hepatitis B. As a result, research that seeks to validate or invalidate whether such trend exist is warranted. Hepatitis B and HIV share common risk factors (Abera, 2014). Among these risk factors are sexual behavior and drug use. Risk factors for both diseases should be explored within the African America women population in ordered to determine their true risk for contracting the disease.

Drug Use

Multiple studies have established that injected drug use (IDU) puts an individual at greater risk for contracting HBV. Commonly, infection in this population occurs when exchanging or sharing needles, facilitating contact with infected blood of a Hepatitis B positive person. Despite the plethora of research in this area; only a fraction of the research involves or is directed at African Americans, specifically black females who have history of IDU and no-injected drug use (NIDU).

Cooper et al. (2008) created a study where NIDU turned ID were followed to explore sexual changes when the individual began injecting. Females who were users of injected drugs tend to be involved in relationships with male injected drug users. These relationships were commonly formed with older males who, based on past research, have been shown to be at

higher risk of contracting blood borne diseases such as Hepatitis (Evans et al., 2003). Mackesy-Amity et al. (2012) observed that within the study population; women were at increased odds of trading sex if they began using injected drugs.

Beyond the scope of injected drug use, African American drug use as a whole creates a huge health disparity within that population. Persons who use non-injected drugs are also at risk for contracting blood borne illness via risky sexual behavior (Celentano et al., 2008). In Celentano et al (2008) study among NID and IDU in a Baltimore city, 68% of the drug use population was African American crack/nasal heroin users. In many isolated African American communities drug availability is abnormally high (Friedman et al., 2004). Increased availability tends to lead to increased usage which correlates with the initiation of risky behaviors and increase susceptibility to contracting infectious diseases.

Alcohol Use

Current research has shown that alcohol use is a common risk factor in the acquisition of many diseases. Alcohol induces a sedation state which impairs the individual's judgment and alters their behavior. The greater percent of research which focus on alcohol use have been among the white population. However, Bachman et al. (1991) study found that African American adolescents and young adults engage in less heavy drinking than their white counterpart. These findings may explain why African Americans are often overlooked in studies focusing on alcohol use. The lack of research data leaves the African American population less informed about the effects of alcohol specific to their race. Pedersen et al.'s (2012) posit that when comparing the response rate after alcohol consumption between Europeans and African Americans; African Americans needed fewer drinks to feel intoxicated. The women of the study also showed greater sedation with less alcohol consumption when compared to men. Some

believe that this difference is due to peer perception and how much the African American individual assumes their counterpart consumes (Martin et al., 2013).

The effect of increased sedation among African American females may contribute to poor judgment and risky behavior and consequently increase risk for contracting an infectious disease. Alcohol use has been associated with many adverse effects and health consequences. Sexual behavior and sexually transmitted diseases have been adversely linked to alcohol use (Seth et al., 2011). Individuals under the influence of alcohol are more likely to make poor decisions to include selection of sex partner. Consequently, individuals under the influence of alcohol are more at risk of becoming infected with Hepatitis B, HIV and other infectious disease due to increase risky behavior (Seth et al., 2011).

Sexual Behavior

Coming in contact (sex, IVDU) with the bodily fluid of a Hepatitis B infected individual increases the risk of contracting the disease. Sexual behavior has been shown to play a role in the epidemiology of the disease. Knowledge, attitudes and practices of sexual behavior maybe key in understanding the role of risky sexual behavior and one's risk of contracting HBV.

Risky sexual behavior encompasses early age of sexual initiation, large number of sexual partners, anal sex, decreased condom use, and partner choice (Pflieger et al., 2013). Black females make up half of the newly reported cases of sexually transmitted diseases in ages 15-24 (Pflieger et al., 2013). These statistics are peculiar because several studies found that the likelihood of black female youths heavily dabbling in risky sexual behavior is lower when compared to white females (Halpern et al., 2004). Such findings led researchers to key in on the black female's partners. Black female sex partners are predominately black males. (Halpern et

al., 2004). Within Rosenthal's study, black males showed higher incidences of having multiple partners, limited condom usage and increased rates of incarceration (Rosenthal et al., 2014).

Another contributing factor to individuals engaging in risky sexual behavior is discrimination. Research has found a correlation between discrimination and engagement in risky sexual behavior among African American women. In Rosenthal et al.'s (2014) study, a group of minority pregnant women were interviewed about their sexual behavior, views on discrimination and history of STIs. The researcher observed that stereotypes/labels, coping mechanisms, and the lack of power were all driving factors of discrimination within minority women. The researcher suggest that distrust for the United States government due to past treatment of ancestors may cause distrust for many government/state run businesses to include healthcare facilities. This may lead minority women to reject health advice given by the health system or avoid seeking service or care at such facilities. There are some stereotypes/labels that deem minority women as promiscuous and sexual property of men. These stereotypes may decrease confidence in these women leading them to engage in more risky behavior because of the diminished view of their self-worth. Some may also feel that they have less power in their relationships; particularly on sexual matter and, as a consequence, subjugate to the will of their partners. The stressors of daily discrimination and economic issues may also cause the female to use sexual activity as a release, stress reliever, or a bargaining chip.

Social Economic Status (SES)

SES encompasses several factors including education, income and occupation (American Psychology Association, 2015.). Blacks are disproportionately represented among the lower socioeconomic class. Black children are three times more likely to grow up in lower income families than their white counterparts. Rogers (2008) pointed out that unemployment rates for blacks are double that of whites. Persons of lower socioeconomic status also tend to have low

literacy and diminished health literacy rates (Bennett et al., 2006). Many of those found in the lower SES have been found to lack health insurance which often limits their access to healthcare (Zarcadoolas, 2010).

Limited healthcare and income leads to limited healthcare use. An important part of healthcare services is vaccination. The literature is replete studies that demonstrate the benefits of vaccinations and the impact on infectious diseases around the world. Unvaccinated persons are at high risk for contracting Hepatitis B infections (CDC, 2010). Black females who are hugely affected by low SES may not have access to health care nor have adequate insurance to obtain vaccinations for their children. The burden associated with a lower SES not only affects the black female's health but drives her behaviors as well. Women with lower socioeconomic status tend to engage in risky sexual behavior, drug use and are less likely to live in a married household (Cooper et al., 2007 and Rosenthal et al., 2014).

Marital Status

Since the 1940s research has shown that blacks are less likely to marry than whites (Torr, 2011). Studies have shown marriage to be a positive factor and beneficial to couples. Many government and community officials have stressed the importance of marriage in many different arenas. Single women have higher rates of welfare dependence as well as higher rates of poverty than married women (Lichter et al., 2004). Marriage has been shown to be beneficial across all racial groups however; least beneficial among black couples (Jackson et al., 2014). Jackson states black married couples tend to have less education and higher unemployment rates. They also lack supportive social networks which may hinder the longevity and quality of the relationship.

In contrast to other married women, black single women often shoulder the responsibility of providing care for their children born out of wedlock. According to the CDC, in 2013 71.5% of child births among African American women occurred in those who were unmarried (CDC, 2015). Black women are less likely to marry or stay married according to Cherlin, 1992. Black females living alone face financial and other confounding difficulties. Black women with lower income may have less access to healthcare. Along with financial problems unmarried women also tend to have more sexual encounters than married women. Sexual contact outside of marriage as well as lower income and limited access to healthcare, among other things, seem to burden the black female population and may serve as contributing factors to their increase risk of contracting infectious diseases.

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CHAPTER III – Manuscript

Introduction

Despite the noted successes in the control of the Hepatitis B spread throughout the United States, there is still a significant number of individuals at risk for future infection. This disease has major implications if it remains in the body system (chronic Hepatitis B). This long-term infection may lead to severe health issues such as liver complications and mortality (CDC, 2010). The virus is preventable through vaccination. The widespread use of vaccination; however, has not eliminated the occurrence of Hepatitis B in the United States. CDC surveillance has shown that the majority of Hepatitis cases in 2012 were among non-Hispanic black persons (CDC, 2014). Recent studies also found that the incidence of HIV is high in the non-Hispanic black female population. Many of the risk factors that contribute to the acquisition of HIV transmission are similar in Hepatitis B (CDC, 2014). Risky behavior and demographics seems to be determining risk factors for acquisition of the HIV virus.

The purpose of this study was to explore the susceptibility for the Hepatitis B virus among non-Hispanic black females in comparison to other races and identify risk factors that influence susceptibility.

Methods and Procedures

Data Source

For the purposes of this study I utilized the 2011-2012 datasets from the National Health and Nutrition Examination Survey (NHANES). The NHANES database uses a cross-sectional sample to make estimates of the United States population. The survey obtained health information from the participants through laboratory test, health questionnaire and physical

examinations. The following datasets were merged for this study: Demographics, Drug Use, Alcohol Use, Healthcare, Health Insurance, HIV and Hepatitis B test results. .

Inclusion and Exclusion Criteria

This study is limited to all participants between the ages of 18 and 59 in the NHANES 2011-2012 datasets. All participants with a missing Hepatitis B blood test result were excluded from the study.

Independent Variables

Race/ethnicity: The main independent variable for this study was race/ethnicity. The participant self-reported their race and ethnic status. The race descriptions were Mexican American, Other Hispanic, Non-Hispanic White, Non-Hispanic Black, Non-Hispanic Asian and Other Race (including Multi-Racial). For the purposes of this study Mexican American and Hispanics were grouped together and all other categories remained as separate entities.

Age: The variable age was calculated using the participant's date of birth. For this study, age was categorized into 4 different groups: (18-29), (30-39), (40-49) and (50-59). This population age grouping was selected based on NHANES limited responses; certain portions of the surveys were limited to certain age groups. The 18-59 age range captured most of the available responses.

SES: The socioeconomic status was measured by the ratio of family income to poverty level, which measures the distance in which the family's income falls from the poverty line. This ratio calculation was obtained through poverty guidelines from the Department of Health and Human Services. For the purposes of this study the ratios were grouped as less than 130% of the poverty line, 130%-349% of the poverty line and $\geq 350\%$ of the poverty line.

Insurance coverage: Participants responded Yes or No to the question ascertaining whether they were covered by any type of health insurance or health plan at the time of completion of the survey.

Access to healthcare facility: Participants self-reported whether they had one or many routine places where they access healthcare. If they responded to having at least one place to receive care they were coded as having “access to healthcare facility” and if they had no place for care they were coded as “no access to healthcare facility.”

Marital status: Participants self-reported their marital status/living arrangements. For the study marital status was defined as (married or living with partner), (divorce, separated, or widowed) and (never married).

Drug use: Participants self-reported to the question ascertaining ever used Marijuana (Yes or No). Participants also reported their use of Heroin, Cocaine, or Methamphetamine (Yes or No). For this study both variables were combined and an affirmative response for one or both questions was classified as a drug user, while those who responded negatively to both questions were classified a non-drug user.

Alcohol use: If the participant self-reported having at least 12 drinks within the year they were categorized as an alcohol user. If the participant responded no then he/she was considered not a user of alcohol.

Sexual behavior: There were two behavior questions used for the purpose of this study. 1) Number of times had sex without condom? The responses to this question were categorized as Never, Sometimes, and Always/More than half. 2) Do you use a condom during oral sex? The self-reported responses to this question were categorized as Never/Rarely and Usually/Always.

HIV status: Through NHANES laboratory testing participants were tested for HIV antibodies.

Participants who tested positive obtained a positive HIV status for the study and those who tested negative for the antibody obtained a negative HIV status.

Dependent Variable

Hepatitis B susceptibility: Through NHANES laboratory testing participants were screened for the Hepatitis B virus. Screening included results of the Hepatitis B: core antibody, surface antigen and surface antibody. Table 1 shows interpretation of Hepatitis B virus test results. If an individual tested negative for surface antigen, negative for surface antibody and negative for core antibody then they were considered susceptible to Hepatitis B infection. Individuals classified as “susceptible” to Hepatitis B infection are individuals that have not had prior HBV infection or have not been vaccinated against HBV. Individuals who tested negative for the surface antigen, positive for the surface antibody and negative/positive for the core antibody were no longer susceptible to future infection. These individuals were classified as “not susceptible” to the virus and may have acquired their susceptibility through successful vaccination or recovery from a prior infection and consequently, not contagious.

Table 1. Interpretation of Hepatitis B Virus blood test.

Test	Results	Interpretation
Hepatitis surface antigen Hepatitis surface antibody Hepatitis core antibody	Negative Negative Negative	No previous infection but at risk for future infection. Vaccination needed.
Hepatitis surface antigen Hepatitis surface antibody Hepatitis core antibody	Negative Positive Negative or Positive	Successful vaccination Or Recovery from previous infection

Analysis

For this study SAS 9.3 software was used for the analysis. NHANES weighing variables were utilized to correct for oversampling that was done in NHANES. Pearson’s chi-squared test was

used to provide basic statistics of the study population by race/ethnicity. A univariate logistic regression analysis was used to determine the association between each variable of interest against the outcome of interest, negative Hepatitis B surface antibody results among the racial/ethnicity groups. In multivariate logistic regression analysis was adjusted for all variable of interest. A second multivariate logistic regression model was used to compare the risk factors of interest by gender. Greater than 35% of the responses for the sex variables were missing. As a result, the sex variable were not included in final female analysis. A third multivariate logistic regression was run among the total population including all sex variables.

Results

Descriptive statistics of study population

Table 2 shows racial/ethnic groups weighted in accordance of the United States female population during 2011-2012. Of the 1,864 females included in the study: 405 (21.735%) were Hispanic, 605 (32.46%) were non-Hispanic white (NHW), 514 (27.585) were non-Hispanic blacks (NHB) and 340 (18.24%) of the study population were other races. Non-Hispanic black females had the lowest percentage of married individuals among the racial groups (36%). Hispanics and NHB females had the highest levels of poverty (45%). Hispanic females had the highest portion of persons not covered by insurance (45%). NHB and Hispanics also had the highest percentage of subjects who had no access to healthcare facilities (20.20%). NHW females showed the highest number of subjects with risky behavior including lack of condom use during sex, alcohol use, and drug use with values of (96.76%, 83.63% and 62.75%), respectively.

Table 3 shows age distribution of males ages 18-59 within this study. 405 (22.17%) of males within the population were Hispanic. 605 (33.33%) males within the population were

NHW. 514 (28.35%) of the male population were NHB. 340 (18.75%) of the study population were other racial groups.

Proportion of Hepatitis B Susceptibility by Race and Gender

Figure 1 shows the proportion of females and males ages 18-59 within the study that were susceptible to the Hepatitis B Virus. Among the female groups Hispanics had the highest prevalence of susceptibility of all female racial ethnic groups (68.70%).” Other” racial ethnic groups had the lowest level of susceptibility (45.14%) among the female population. NHW showed 65.53% of its female population was susceptible to the virus while 59.88% of NHB females were susceptible.

73% of Hispanic and NHW males were susceptible to Hepatitis B. NHB males followed with 67.67% of its population being susceptible to Hepatitis B. 51.52% of other racial male groups were susceptible to Hepatitis B.

Predictors of Susceptibility by Female Race (unadjusted)

Table 4 shows the unadjusted odds ratios of the female study population. Hispanics were less likely to be associated with susceptibility to the Hepatitis B Virus within age groups 18-29 compared to age groups 50-59 (Unadjusted Odds Ratio [UOR= 0.17, CI=0.11- 0.28). Hispanics who were never married were less likely to be susceptible to the virus when compared to those married/living with a partner (UOR= 0.38, CI= 0.24-0.59). Persons within the Hispanic group who were at or above 350% income-to-poverty were less likely to be susceptibility to the virus when compared to those who fell 130%-349% of the poverty line (UOR= 0.59, CI= 0.38-0.93). Hispanics without insurance were 1.73 times more likely to be susceptible (UOR= 1.73, CI= 1.14-2.62). Hispanic drug users were less likely to be susceptible to the virus when compared to non-drug users (UOR= 0.42, CI= 0.24 – 0.72). Hispanics who practiced unsafe sex (no condom

use always/more than half of sexual encounters) were less likely to show susceptibility to the virus (UOR= 0.40, CI, 0.25-0.89).

NHW females ages (18-29) were less likely than NHW females between the ages of (50-59) to show susceptibility to the virus (UOR= 0.11, CI= 0.05-0.26). Middle age NHW females who were ages (30-39) were less likely to show susceptibility (UOR=0.30, CI= 0.19 -0.47).

NHW females who have never been married were less likely meet the requirements of susceptibility when compared to those who were married/living with a partner (UOR=0.46, CI= 0.26 -0.81).

NHB subjects who were 18-29 years of age were less likely to be considered susceptible to the Hepatitis B virus when compared to those 50-59 years of age (UOR=0.20, CI= 0.11- 0.36). NHB who were never married were less likely to show susceptibility when compared to those who were married/living with a partner (UOR= 0.59, CI = 0.42-0.83). Alcohol users within this group were less likely to be susceptible to the virus than non-alcohol users (UOR=0.65, CI= 0.31-0.91). Those within this group who sometimes did not use condoms during sex were less likely to show susceptibility to future infection (UOR=0.53, CI= 0.331 -0.91).

The only significance shown within the multiracial group was among those who did not use condoms during sex. Within this population those who did not use condoms were less likely to show susceptibility than those who always used condoms during sex (UOR=0.44, CI= 0.24-0.83).

Predictors of Susceptibility by Female Race (adjusted)

Table 5 shows an adjusted logistic regression model for each racial group among the female population. Within this model was age groups (18-29), (30-39), (40-49) compared to the referent group of ages (50-59). Marital status was also used in this model comparing those who

were never married, divorced/separated/widowed to the referent group of those married or living with a partner. The model also includes family income-to-poverty levels. Those >130% and those >=350% were compared to those falling between (130%-34%) of the family income-to-poverty level. Persons within the groups with no insurance coverage were compared to those who had active insurance coverage. Persons who had no access to a healthcare facility were compared to those who had access to a healthcare facility. Persons negative for HIV were compared to positive HIV results. Alcohol users were compared to non-alcohol users. Drug users were compared to non-drug users. This module excludes condom use during sex variable and condom use during oral sex variable due to over 34% missing values.

Hispanics were less likely to be associated with susceptibility to the Hepatitis B Virus within age groups 18-29 compared to age groups 50-59 (Adjusted Odds Ratio [AOR= 0.13, CI=0.06- 0.28). NHW were less likely to be associated with susceptibility to the Hepatitis B Virus within age groups 18-29 compared to age groups 50-59 (AOR= 0.09, CI=0.03- 0.26). NHB were less likely to be associated with susceptibility to the Hepatitis B Virus within age groups 18-29 compared to age groups 50-59 (AOR= 0.19, CI=0.08- 0.44). Other/Multiracial groups were less likely to be associated with susceptibility to the Hepatitis B Virus within age groups 18-29 compared to age groups 50-59 (AOR= 0.22, CI=0.08- 0.67. 18-29 population compared to the older 50-59 population showed lower odds throughout the categories of being susceptible to the Hepatitis B virus. The NHW group was the only group to show significance within the family income- to-poverty variable. Persons below the poverty line were 1.77 more likely to show susceptibility compared to the middle income poverty level (Adjusted Odds Ratio [AOR= 1.77, CI=1.04-3.02).

Within the Hispanic group those with no insurance were 2.49 times more likely to be susceptible to the virus (AOR= 2.49, CI= 1.07-4.65). This group also showed significance in results to access to care. Those with no access to care were 2.64 times more likely to be susceptible to the virus (AOR= 2.64, CI= 1.01-6.88). NHW also showed significance with access to care variable. Those without access to healthcare facilities were 2.24 times more likely to be susceptible to Hepatitis B virus (AOR= 2.24, CI= 1.07-4.65).

Hispanic drug users showed lower odds of susceptibility when compared to Hispanic non-drug users. They were less likely to be susceptible to Hepatitis B virus (AOR= 0.47, CI= 0.22-0.99).

Among the female population within the NHB females had the third highest proportion of susceptibility for the Hepatitis B virus. When compared to only female participants' potential risk factors that place NHB females most at risk for susceptibility to the virus was increased age and marriage. Within this group factors such as no condom use and alcohol use seem to lower the odds of susceptibility to the virus.

Predictors among study population by Gender (adjusted)

Table 6 included results from a logistic regression model by gender. The female and male population models included race, age, marital status, family income-to-poverty ratio, insurance coverage, access to care, HIV status, alcohol use and drug use. This module excludes condom use during sex and condom use during oral due to over 34% and 50% missing response.

Among the males within the population other/ multiracial groups were less likely to be susceptible to Hepatitis B when compared to NHW males (AOR= 0.34, CI= 0.22-0.54). Males between ages (18-29) were less likely to be susceptible to the virus when compared to age groups (50-59) [AOR= 0.25, CI= 0.13-0.47]. Males who were divorce/separated/widowed were 2.1

times more likely to be susceptible than males who were married/living with a partner (AOR= 2.1, CI= 1.20-3.67). Males with no insurance were 2.12 times more likely to be susceptible to the virus than those without insurance coverage (AOR= 2.12, CI= 1.40-3.20). Males who tested positive for HIV were less likely to be susceptible to Hepatitis B than those who tested negative (AOR=0.16, CI= 0.03-0.90).

Within the female population the other/multiracial group was less likely to be susceptible to the virus than NHW (AOR= 0.55, CI= 0.34-0.89). The females within age groups (18-29) were less likely to be susceptible to the infection than the eldest age group of (50-59) [AOR=0.11, CI=0.06-0.23]. Females who had less than 130% family income-to-poverty levels were 1.35 times more likely to be susceptible to Hepatitis B than females who fell within the 130%-349% family income-to-poverty level (AOR=1.35, CI= 1.04-1.75). Females with no access to care were 1.78 times more likely to be susceptible to the virus than those who had access to care (AOR=1.78, CI= 1.19-2.65).

Predictors among study population by Gender (adjusted including sex variables)

Table 7 included results from a logistic regression model by genders including race, age, marital status, family income-to-poverty, insurance coverage, access to care, HIV status, alcohol use, drug use, condom use during sex and condom use during oral sex. Of the 3,677 total population, 2125 responses were deleted due to missing response (57.79%).

Within the male population significance was shown in the association among the multiracial group. Multiracial males were less likely to show susceptibility to the virus (AOR= 0.4, CI= 0.26 – 0.61). Males without insurance were 2.52 times more likely to be susceptible to the Hepatitis B virus (AOR= 2.52, CI= 1.73-3.66).

Within the female population Hispanics were 1.72 times more likely to be associated with susceptibility to Hepatitis B infection when compared to NHW (AOR=1.72, CI=1.14-2.6). Female age groups (18-29) and (30-39) showed significantly lower odds of being susceptible to Hepatitis B virus [(AOR=0.11, CI=0.05-0.27) and (AOR=0.36, CI= 0.19-0.71)]. Females who were never married were less likely to be susceptible to Hepatitis B virus when compared to females who were married/living with a partner (AOR= 0.62, CI= 0.44-0.87). Females with no access to healthcare facilities were 1.72 times more likely to be susceptible to Hepatitis B infection when compared to females with access to healthcare facilities (AOR= 1.72, CI=1.22-2.43). Females who almost always did not use condoms were less likely to be susceptible to being infected when compared to those who always used condoms during sex (AOR=.57, CI=0.36-0.90).

When compared to males within the population female participants were at higher odds of susceptibility when they fell less than 130% below the poverty line and when they had no access to healthcare. Males within the population showed higher odds to susceptibility when they were divorce/separated/widowed and when they had no insurance coverage.

Discussion

This study identified a number of factors that contributed to the increase and decrease susceptibility to Hepatitis B within the study population. Drug users, individuals who were never married and individuals who were younger in age were presented with lower odds of being susceptible to the virus. Increased odds of susceptibility were present among those with no insurance coverage and participants with no access to care.

Lower odds of susceptibility were shown among drug users. Hispanic drug users in particular showed significantly lower odds of future infection of Hepatitis B. Studies have shown

that drug users are at high risk for contracting the Hepatitis B virus so targeted interventions have been developed with aims to increase vaccination among this group (Bolao et al, 2010). One such intervention was described by Ballesta et al., 2008. The study described an intervention that focused on mass vaccination of drug users within prisons and substance abuse centers. Immunity not gained through vaccination, natural immunity, has also been present among drug users. Drug users who successfully recover from the Hepatitis B infection develop a natural immunity to the disease. Infection recovery may increase with the proper resources, however; Bolao et al., 2010, noted a stable level of natural immunity within this group since 1992. Bolao also reported that within a study of drug users the average age of the user was 28 (Bolao et al., 2010). It is essential to observe the age distribution of the drug users in order to determine where their susceptibility or lack thereof may come from. Younger drug users may be those obtaining immunity through vaccination and the older population may be obtaining immunity through infection.

Persons within the non-Hispanic white group were more likely to be susceptible when they fall below the income-to-poverty line and also when they did not have access to healthcare facilities. Ahmed describes a study where non-vaccinated and vaccinated persons were studied to determine possible risk factors to the Hepatitis B surface antibody (Ahmed, 2015). The study observed 204 non-vaccinated patients, many of whom were considered low-income individuals. Within this group of non-vaccinated individuals only 33% developed natural immunity leaving 77% susceptible to infection. Ahmed stressed the importance of vaccination for future protection of the susceptible population. Without access to healthcare facilities, vaccination sites are limited. This may explain the higher associations to susceptibility found in groups with no access to healthcare facilities.

A similar situation was found within the Hispanic group in this study. Among this group significant factors that were associated with susceptibility were no insurance coverage and no access to healthcare facilities. Vaccination for diseases such as Hepatitis B are often covered under many insurance plans and offered at majority of healthcare facilities. Between 1990-2005, Hepatitis B within the United States declined dramatically. The decline in the number of Hepatitis B cases during that period coincided with the increase Hepatitis B vaccinations among the youth (CDC, 2005). Without places to obtain vaccination or means to obtain the vaccination (insurance coverage) trends such as the one seen within the Hispanic group in this study will continue to place lower income Hispanics with no access to care at risk for contracting Hepatitis B.

A significant trend was shown within this study among the age groups. All racial groups showed significant associations of lower odds of susceptibility in age groups (18-29) when compared to the other age categories. This trend may be explained by successful child and adolescent immunization. CDC reports that an increase in youth and adolescent vaccination has led to lower incidences in some infectious diseases (CDC, 2006). There was a 78% decline in the Hepatitis B infection rate from 1999-2005 (CDC, 2005). 96% of the decline was among the younger adolescents. During period of vaccination success the (18-29) population within the NHANES group were of the suggested age of youth vaccination. Many of the groups lower in age of the study were more likely to be vaccinated according to the timeline of past research.

Hispanic, non-Hispanic black and non-Hispanic whites showed significant association between susceptibility and marital status. Persons who were never married had lower odds of susceptibility compared to other marital status groups. These 3 racial groups account for the highest of non-married individuals in 2006-2010 (Cohen et al., 2012). The marital status

association to susceptibility maybe confounded by age. Cohen reported that the population as a whole has been getting married at a later age. Never married persons within this study maybe younger and in turn more likely to have lower odds of susceptibility.

Within this study lower odds of susceptibility were found in Hispanics and non-Hispanic blacks who often practiced unprotected sex. This may be due to the NHANES questionnaire. Respondents were asked, “How many times have you had sex without a condom this year?” The responses were (never, less than half of the time, about half of the time, not always and always) It is possible that the respondent may have misread the question and responded to the question and in turn responded opposite to their actual behavior. The questionnaire is given to a variety of education levels and misinterpretation of the question maybe possible. The sexual behavior questions were also missing more than 30% of responses which may have caused analytical issues.

The strength of this study is its ability to generalize to the United States population using weighted measures within the NHANES database. By using the NHANES survey I was also allowed to combine self-reported data as well as clinical data using laboratory testing and medical examination. The confirmation used with the clinical data allowed accuracy in determining the susceptibility outcome variable.

Limitations of the study involved the sexual behavior and drug use portions of the questionnaire. The variables were self-reported which may have caused response bias. This may explain the substantial amount of missing responses within the sexual behavior question. Another limitation was not knowing specifically where each individual gained their immunity (vaccination/natural immunity).

The key public health message to take away from this study is the importance of

vaccination. Despite past efforts, there are still people within the United States who are susceptible to Hepatitis B. Morbidity and mortality from chronic Hepatitis B infection is preventable. Future public health interventions should continue to focus on vaccination within drug abuse centers and prisons. Implementation of vaccination in primary care practice among unvaccinated older adults may help alleviate the higher levels of susceptibility among older adults. As stated earlier vaccination programs work and targeting populations who have high susceptibility to viruses such as Hepatitis B may prove to be beneficial.

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APPENDIX

Table 2. Characteristics of female study population by race/ethnicity, NHANES, 2011-2012 (n=1864).

	Study Population		Hispanic (n = 405)		White Non-Hispanic (n = 605)		Black, Non-Hispanic (n=514)		Other Race/Multiracial (n=340)	
	n	%	n	Weighted %	n	Weighted %	n	Weighted %	n	Weighted %
Age (yr)										
18-29	572	30.69	131	34.20	148	23.40	182	32.10	111	33.64
30-39	435	23.34	96	27.19	178	21.48	76	22.19	85	24.00
40-49	433	23.30	87	22.12	145	26.06	120	23.45	81	26.07
50-59	424	18.53	91	16.50	134	29.06	136	22.26	63	16.28
Marital Status										
Married or living with partner	979	52.52	228	64.06	372	67.53	167	36.14	212	63.63
Divorced, separated, or widowed	296	15.88	68	16.53	114	17.13	89	17.53	25	7.79
Never married	456	24.46	67	19.42	96	15.34	207	46.34	86	28.59
Family Income-to-Poverty*										
Less than 130% (i.e. below poverty level)	685	36.75	171	45.74	216	19.35	219	45.24	79	23.61
130% - 349%	542	29.08	130	36.42	165	31.92	149	31.26	98	35.50
>= 350%	503	26.98	59	17.85	201	48.73	110	23.51	133	40.89
Insurance Coverage										
Yes	1381	74.09	229	54.91	473	83.98	408	78.22	271	80.27
No	481	25.80	175	45.09	132	16.02	106	21.78	68	19.73
Access to Healthcare facility										
Yes	1596	85.62	323	79.80	527	88.67	474	91.98	272	81.62
No	268	14.38	82	20.20	78	11.33	40	8.02	68	18.38
HIV Status										
Positive	5	0.27	0	0.00	0	0.00	5	0.92	0	0.00
Negative	1823	97.80	398	100.00	597	100.00	499	99.08	329	100.00
No Condom Use during sex										
Never	326	17.49	105	39.87	75	17.32	90	24.81	56	28.57
Sometimes (less than half/half)	238	12.77	45	16.98	52	10.52	99	27.85	42	27.34
Always/More than Half	651	34.92	104	43.15	299	72.16	163	47.34	85	44.09
Condom Use during oral sex*										
Never/Rarely	795	42.65	148	85.91	336	96.76	193	86.86	118	90.00
Usually/Always	88	4.72	25	14.09	15	3.24	33	13.14	15	10.00
Alcohol use										
Yes	1038	55.69	187	58.27	430	83.63	289	65.86	132	61.11
No	540	28.97	145	41.73	105	16.37	164	34.14	126	38.89
Drug Use										
Yes	726	38.95	109	36.69	329	62.75	222	49.00	66	35.44
No	830	44.53	217	63.31	203	37.25	228	51.00	182	64.56

Bold face font, $p < 0.05$.

Missing data not shown for marital status (n=133)7.14%, family income to poverty (n=134)7.19%, insurance coverage (n=2) .11%, HIV status (n=36)1.93%, No condom use during sex (n=649)34.82, Condom use during oral sex (n=981)52.63%, Alcohol use (n=286) 15.34%, Drug use (n=308) 16.52.

Data is weighted to represent the US population and to account for oversampling and nonresponse to the household interview and physical examination.

p -values are derived from Chi-square test

Table 3. Characteristics of male population by race/ethnicity, NHANES, 2011-2012 (n=1813).

	Study Population		Hispanic (n = 405)		White Non-Hispanic (n = 605)		Black, Non-Hispanic (n=514)		Other Race/Multiracial (n=340)	
	n	%	n	Weighted %	n	Weighted %	n	Weighted %	n	Weighted %
Age (yr)										
18-29	588	32.43	131	34.39	178	26.24	157	33.62	122	29.92
30-39	436	24.05	95	27.24	173	20.67	86	21.00	82	24.57
40-49	395	21.79	85	22.41	150	25.16	83	20.54	77	24.92
50-59	394	21.73	81	15.96	136	27.93	107	24.84	70	20.58
Marital Status										
Married or living with partner	973	53.67	241	66.85	346	59.77	187	47.32	199	60.16
Divorced, separated, or widowed	189	10.42	41	10.86	83	12.43	47	12.65	18	8.51
Never married	507	27.96	72	22.29	170	27.81	157	40.04	108	31.33
Family Income-to-Poverty*										
Less than 130% (i.e. below poverty level)	603	33.26	148	40.42	229	20.20	151	37.94	75	21.47
130% - 349%	551	30.39	144	39.38	177	31.68	124	33.32	106	38.40
>= 350%	513	28.30	68	20.20	209	48.13	106	28.73	106	40.13
Insurance Coverage										
Yes	1200	66.19	184	47.20	469	81.29	287	67.01	260	67.97
No	610	33.65	208	52.80	168	18.71	143	32.99	91	32.03
Access to Healthcare facility						100.00		100.00		100.00
Yes	1311	72.31	246	63.18	487	78.79	325	75.0537	253	71.47
No	502	27.69	146	36.82	150	21.21	108	24.9463	98	28.53
HIV Status										
Positive	14	0.77	3	0.68	3	0.48	8	1.96	0	0.00
Negative	1764	97.30	383	99.32	625	99.52	412	98.04	344	100.00
No Condom Use during sex										
Never	363	20.02	93	33.60	100	21.88	90	27.99	80	30.50
Sometimes (less than half/half)	292	16.11	66	23.88	85	17.47	87	30.07	54	20.64
Always/More than Half	611	33.70	112	42.52	288	60.65	125	41.94	86	48.86
Condom Use during oral sex*										
Never/Rarely	856	47.21	168	84.16	387	94.35	165	75.69	136	92.05
Usually/Always	131	7.23	32	15.84	29	5.65	55	24.31	15	7.95
Alcohol use										
Yes	1402	77.33	309	89.33	551	93.16	314	81.79	228	73.69
No	246	13.57	41	10.67	49	6.84	77	18.21	79	26.31
Drug Use										
Yes	1011	55.76	186	56.46	424	71.77	267	69.75	134	51.34
No	611	33.70	159	43.54	172	28.23	119	30.25	161	48.66

Bold face font, $p < 0.05$.

Missing data not shown for marital status (n=144) 7.94%, family income to poverty (n=146) 8.05%, insurance coverage (n=3) .17%, HIV status (n=35) 1.93%, No condom use during sex (n=547) 30.17, Condom use during oral sex (n=826) 45.56%, Alcohol use (n=165) 9.10%, Drug use (n=191) 10.54%.

Data is weighted to represent the US population and to account for oversampling and nonresponse to the household interview and physical examination.

p -values are derived from Chi-square test

Table 4. Unadjusted Odds Ratios (UOR) and 95% Confidence Intervals (CIs) for Characteristics Associated with susceptibility to Hepatitis B Virus within females, NHANES, 2011-2012.

	Hispanic		White, Non-Hispanic		Black, Non-Hispanic		Other/Multiracial	
	UOR (95% CI)	p-value	UOR (95% CI)	p-value	UOR (95% CI)	p-value	UOR (95% CI)	p-value
Age (yr)								
18-29	0.17 (0.11 - 0.28)	<.0001	0.11 (0.05 - 0.26)	<.0001	0.2 (0.11 - 0.36)	<.0001	0.61 (0.29 - 1.28)	0.193
30-39	0.7 (0.36 - 1.35)	0.2836	0.3 (0.19 - 0.47)	<.0001	0.61 (0.23 - 1.59)	0.3113	1.48 (0.7 - 3.14)	0.303
40-49	1.3 (0.74 - 2.28)	0.365	0.52 (0.26 - 1.04)	0.066	0.88 (0.49 - 1.57)	0.6639	1.68 (0.79 - 3.6)	0.180
50-59	1.0 (Reference)		1.0 (Reference)		1.0 (Reference)		1.0 (Reference)	
Marital Status								
Married or living with partner	1.0 (Reference)		1.0 (Reference)		1.0 (Reference)		1.0 (Reference)	
Divorced, separated, or widowed	0.96 (0.55 - 1.66)	0.8699	1.67 (0.96 - 2.9)	0.071	1.01 (0.55 - 1.86)	0.9795	0.7 (0.3 - 1.66)	0.422
Never married	0.38 (0.24 - 0.59)	<.0001	0.46 (0.26 - 0.81)	0.007	0.59 (0.42 - 0.83)	0.0022	0.66 (0.31 - 1.39)	0.275
Family Income-to-Poverty*								
Less than 130%	0.73 (0.51 - 1.04)	0.0828	1.05 (0.71 - 1.57)	0.808	0.98 (0.56 - 1.72)	0.9465	0.92 (0.36 - 2.32)	0.851
130% - 349%	1.0 (Reference)		1.0 (Reference)		1.0 (Reference)		1.0 (Reference)	
>= 350%	0.59 (0.38 - 0.93)	0.0227	1.04 (0.69 - 1.57)	0.845	1.27 (0.82 - 1.97)	0.2875	1.02 (0.51 - 2.05)	0.947
Insurance Coverage								
Yes	1.0 (Reference)		1.0 (Reference)		1.0 (Reference)		1.0 (Reference)	
No	1.73 (1.14 - 2.62)	0.0101	1.19 (0.56 - 2.56)	0.648	1.12 (0.68 - 1.82)	0.6623	0.64 (0.35 - 1.18)	0.153
Access to Healthcare facility								
Yes	1.0 (Reference)		1.0 (Reference)		1.0 (Reference)		1.0 (Reference)	
No	1.4 (0.81 - 2.41)	0.2287	1.54 (0.9 - 2.63)	0.119	0.7 (0.43 - 1.13)	0.1408	0.64 (0.35 - 1.18)	0.150
HIV Status								
Positive	1 (0.16 - 6.13)	1	1.15 (0.09 - 14.7)	1.000	2.91 (0.32 - 26.65)	0.344	1 (0.61 - 6.12)	1.000
Negative	1.0 (Reference)	0.632	1.0 (Reference)		1.0 (Reference)		1.0 (Reference)	
Alcohol use								
Yes	0.81 (0.36 - 1.82)	0.6123	0.66 (0.37 - 1.2)	0.172	0.65 (0.45 - 0.93)	0.0183	1.37 (0.77 - 2.45)	0.284
No	1.0 (Reference)		1.0 (Reference)		1.0 (Reference)		1.0 (Reference)	
Drug Use								
Yes	0.42 (0.24 - 0.72)	0.0017	0.9 (0.7 - 1.17)	0.444	1.09 (0.74 - 1.60)	0.6578	0.68 (0.27 - 1.73)	0.417
No	1.0 (Reference)		1.0 (Reference)		1.0 (Reference)		1.0 (Reference)	
No condom use during sex*								
Never	1.0 (Reference)		1.0 (Reference)		1.0 (Reference)		1.0 (Reference)	
Sometimes (less than half/half)	0.4 (0.2 - 0.8)	0.0093	1.67 (0.83 - 3.34)	0.151	0.53 (0.31 - 0.91)	0.0223	0.57 (0.19 - 1.73)	0.323
Always/More than Half	0.47 (0.25 - 0.89)	0.0202	1.12 (0.6 - 2.1)	0.724	0.97 (0.58 - 1.64)	0.9105	0.44 (0.24 - 0.83)	0.011
Condom use during oral sex								
Never/Rarely	1.0 (Reference)		1.0 (Reference)		1.0 (Reference)		1.0 (Reference)	
Usually/Always	0.85 (0.44 - 1.65)	0.628	1.77 (0.79 - 4)	0.169	1.24 (0.44 - 3.5)	0.6846	2.79 (0.66 - 11.75)	0.162

Bold face font, p < 0.05.

Table 5. Adjusted Odds Ratios (AOR) and 95% Confidence Intervals (CIs) for Characteristics Associated with susceptibility to Hepatitis B Virus within females, NHANES, 2011-2012.

	Hispanic		White, Non-Hispanic		Black, Non-Hispanic		Other/Multiracial	
	AOR (95% CI)	p-value	AOR (95% CI)	p-value	AOR (95% CI)	p-value	AOR (95% CI)	p-value
Age (yr)								
18-29	0.13 (0.06 - 0.28)	<.0001	0.09 (0.03 - 0.26)	<.0001	0.19 (0.08 - 0.44)	<.0001	0.22 (0.08 - 0.67)	0.007
30-39	0.41 (0.15 - 1.13)	0.084	0.26 (0.14 - 0.49)	<.0001	0.67 (0.25 - 1.81)	0.427	0.69 (0.23 - 2.11)	0.518
40-49	0.96 (0.37 - 2.49)	0.937	0.56 (0.27 - 1.16)	0.121	0.8 (0.43 - 1.5)	0.485	1.77 (0.63 - 4.99)	0.281
50-59	1.0 (Reference)		1.0 (Reference)		1.0 (Reference)		1.0 (Reference)	
Marital Status								
Married or living with partner	1.0 (Reference)		1.0 (Reference)		1.0 (Reference)		1.0 (Reference)	
Divorced, separated, or widowed	0.44 (0.16 - 1.24)	0.120	1.06 (0.62 - 1.81)	0.847	0.68 (0.29 - 1.6)	0.376	0.44 (0.12 - 1.57)	0.206
Never married	0.49 (0.19 - 1.25)	0.135	0.85 (0.52 - 1.4)	0.516	0.88 (0.64 - 1.2)	0.406	0.96 (0.44 - 2.08)	0.915
Family Income-to-Poverty*								
Less than 130%	0.75 (0.34 - 1.63)	0.464	1.77 (1.04 - 3.02)	0.035	1.1 (0.58 - 2.1)	0.764	1.16 (0.43 - 3.13)	0.767
130% - 349%	1.0 (Reference)		1.0 (Reference)		1.0 (Reference)		1.0 (Reference)	
>= 350%	0.93 (0.39 - 2.23)	0.865	0.79 (0.46 - 1.36)	0.389	0.92 (0.45 - 1.87)	0.814	0.89 (0.43 - 1.84)	0.747
Insurance Coverage								
Yes	1.0 (Reference)		1.0 (Reference)		1.0 (Reference)		1.0 (Reference)	
No	2.49 (1.27 - 4.9)	0.008	0.95 (0.39 - 2.34)	0.914	1.02 (0.55 - 1.87)	0.958	1.16 (0.62 - 2.17)	0.647
Access to Healthcare facility								
Yes	1.0 (Reference)		1.0 (Reference)		1.0 (Reference)		1.0 (Reference)	
No	2.64 (1.01 - 6.88)	0.047	2.24 (1.07 - 4.65)	0.031	0.99 (0.49 - 1.99)	0.969	0.96 (0.43 - 2.15)	0.917
HIV Status								
Positive	1.0 (Reference)		1.15 (0.09 - 14.7)	0.916	1.5 (0.14 - 15.59)	0.734	2.71 (0.22 - 32.75)	0.433
Negative	1.98 (0.12 - 32.4)	0.632	1.0 (Reference)		1.0 (Reference)		1.0 (Reference)	
Alcohol use								
Yes	1.39 (0.43 - 4.57)	0.585	0.88 (0.4 - 1.96)	0.758	0.5 (0.24 - 1.07)	0.073	2.27 (0.89 - 5.74)	0.085
No	1.0 (Reference)		1.0 (Reference)		1.0 (Reference)		1.0 (Reference)	
Drug Use								
Yes	0.47 (0.22 - 0.99)	0.047	0.74 (0.45 - 1.22)	0.233	1.6 (0.99 - 2.59)	0.055	0.72 (0.24 - 2.13)	0.548
No	1.0 (Reference)		1.0 (Reference)		1.0 (Reference)		1.0 (Reference)	

Bold face font, p < 0.05.

Table 6. Adjusted Odds Ratios (AOR) and 95% Confidence Intervals (CIs) for Characteristics Associated with susceptibility to Hepatitis B Virus within total population, NHANES, 2011-2012.

	Males		Females	
	AOR (95% CI)	p-value	AOR (95% CI)	p-value
Race/Ethnicity				
Hispanics	1 (0.64 - 1.55)	0.997	1.4 (0.97 - 2.02)	0.0744
White, Non-Hispanics	1.0 (Reference)		1.0 (Reference)	
Black, Non-Hispanics	0.83 (0.56 - 1.23)	0.353	0.91 (0.68 - 1.21)	0.5171
Other/Multiracial	0.34 (0.22 - 0.54)	<.0001	0.55 (0.34 - 0.89)	0.0156
Age (yr)				
18-29	0.25 (0.13 - 0.47)	<.0001	0.11 (0.06 - 0.23)	<.0001
30-39	0.67 (0.36 - 1.25)	0.210	0.35 (0.23 - 0.53)	<.0001
40-49	1.41 (0.64 - 3.09)	0.396	0.68 (0.41 - 1.12)	0.1255
50-59	1.0 (Reference)		1.0 (Reference)	
Marital Status				
Married or living with partner	1.0 (Reference)		1.0 (Reference)	
Divorced, separated, or widowed	2.1 (1.2 - 3.67)	0.010	0.88 (0.58 - 1.34)	0.5577
Never married	0.83 (0.63 - 1.08)	0.162	0.82 (0.58 - 1.17)	0.2709
Family Income-to-Poverty*				
Less than 130%	1.16 (0.66 - 2.06)	0.609	1.35 (1.04 - 1.75)	0.023
130% - 349%	1.0 (Reference)		1.0 (Reference)	
>= 350%	0.93 (0.63 - 1.36)	0.695	0.82 (0.57 - 1.17)	0.2722
Insurance Coverage				
Yes	1.0 (Reference)		1.0 (Reference)	
No	2.12 (1.4 - 3.2)	0.000	1.24 (0.78 - 1.99)	0.364
Access to Healthcare facility				
Yes	1.0 (Reference)		1.0 (Reference)	
No	0.75 (0.46 - 1.23)	0.254	1.78 (1.19 - 2.65)	0.0052
HIV Status				
Positive	0.16 (0.03 - 0.9)	0.037	1.61 (0.13 - 19.73)	0.7087
Negative	1.0 (Reference)		1.0 (Reference)	
Alcohol use				
Yes	1.02 (0.64 - 1.61)	0.951	0.97 (0.59 - 1.58)	0.8908
No	1.0 (Reference)		1.0 (Reference)	
Drug Use				
Yes	1.04 (0.77 - 1.41)	0.801	0.8 (0.56 - 1.15)	0.2321
No	1.0 (Reference)		1.0 (Reference)	

Bold face font, p < 0.05.

Table 7. Adjusted Odds Ratios (AOR) and 95% Confidence Intervals (CIs) for Characteristics Associated with susceptibility to Hepatitis B Virus within total population, NHANES, 2011-2012.

	Males		Females	
	AOR (95% CI)	p-value	AOR (95% CI)	p-value
Race/Ethnicity				
Hispanics	0.89 (0.51 - 1.57)	0.684	1.72 (1.14 - 2.6)	0.010
White, Non-Hispanics	1.0 (Reference)		1.0 (Reference)	
Black, Non-Hispanics	0.83 (0.57 - 1.19)	0.299	1.33 (0.79 - 2.23)	0.283
Other/Multiracial	0.4 (0.26 - 0.61)	<.0001	0.65 (0.38 - 1.14)	0.132
Age (yr)				
18-29	0.37 (0.13 - 1.07)	0.066	0.11 (0.05 - 0.27)	<.0001
30-39	0.87 (0.34 - 2.26)	0.779	0.36 (0.19 - 0.71)	0.003
40-49	2.24 (0.83 - 6.07)	0.113	0.8 (0.41 - 1.55)	0.502
50-59	1.0 (Reference)		1.0 (Reference)	
Marital Status				
Married or living with partner	1.0 (Reference)		1.0 (Reference)	
Divorced, separated, or widowed	1.3 (0.61 - 2.76)	0.493	0.76 (0.36 - 1.63)	0.484
Never married	0.72 (0.51 - 1.01)	0.057	0.62 (0.44 - 0.87)	0.006
Family Income-to-Poverty*				
Less than 130%	0.96 (0.56 - 1.63)	0.867	1.39 (0.9 - 2.14)	0.137
130% - 349%	1.0 (Reference)		1.0 (Reference)	
>= 350%	0.87 (0.57 - 1.34)	0.538	0.8 (0.49 - 1.33)	0.393
Insurance Coverage				
Yes	1.0 (Reference)		1.0 (Reference)	
No	2.52 (1.73 - 3.66)	<.0001	1.47 (0.92 - 2.35)	0.104
Access to Healthcare facility				
Yes	1.0 (Reference)		1.0 (Reference)	
No	1.09 (0.61 - 1.97)	0.767	1.72 (1.22 - 2.43)	0.002
HIV Status				
Positive	0.36 (0.02 - 7.57)	0.514		
Negative	1.0 (Reference)		1.0 (Reference)	
Alcohol use				
Yes	1.75 (1 - 3.07)	0.050	1.07 (0.52 - 2.21)	0.859
No	1.0 (Reference)		1.0 (Reference)	
Drug Use				
Yes	0.92 (0.57 - 1.48)	0.739	0.76 (0.44 - 1.31)	0.321
No	1.0 (Reference)		1.0 (Reference)	
No condom use during sex				
Never	1.0 (Reference)		1.0 (Reference)	
Sometimes (less than half/half)	0.85 (0.49 - 1.5)	0.581	1.32 (0.65 - 2.68)	0.446
Always/More than half	0.98 (0.6 - 1.59)	0.927	0.57 (0.36 - 0.9)	0.016
Condom during oral sex				
Never/Rarely	0.7 (0.37 - 1.33)	0.277	0.7 (0.38 - 1.3)	
Usually/Always	1.0 (Reference)		1.0 (Reference)	0.264

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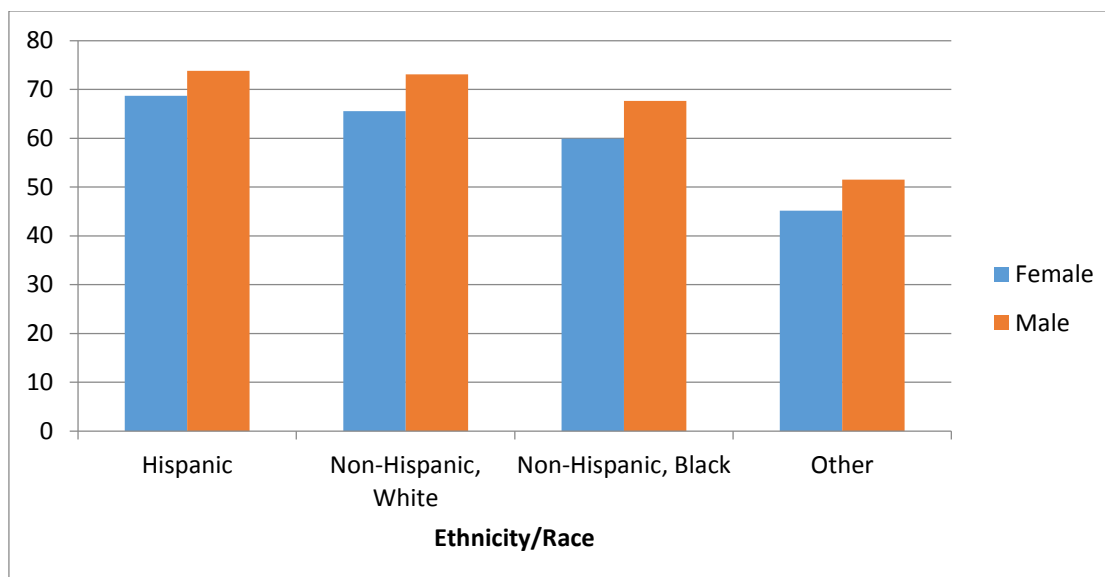


Figure 1. Proportion of susceptibility to Hepatitis B Virus by Gender, NHANES, 2011-2012.